

PHAROS Conference 2019: the multi-messenger physics and astrophysics of neutron stars



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Fat and sexy: Massive pulsars in compact binaries

The maximum mass of a neutron star constrains the properties of ultradense matter and the possible outcomes of double neutron star mergers. Compact binary millisecond pulsars (with orbital periods shorter than about a day) are a rapidly-growing pulsar population, and provide a good opportunity to search for the most massive neutron stars. Because their main sequence companion stars are faint and irradiated, accurate mass measurements in these systems require large optical telescopes. We present observations and detailed modeling of an extremely irradiated companion to a millisecond pulsar. We apply a new method to measure the velocity of both sides of the companion star, and find that the binary hosts one of the most massive neutron stars known to date, with a mass of $2.27^{+0.17}_{-0.15}$ M_{sun} . A 2.3 Solar-mass neutron star would rule out most currently proposed equations of state, casting doubt on the existence of exotic forms of matter in the core.

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